



**Palmetto Section 5
SR 826/836 Interchange
Miami, Florida
“Bridge Design and Construction”**



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Principal and
Assistant Technical Director
Finley Engineering Group, Inc.**

Western Bridge Engineers' Seminar
Wednesday, September 28, 2011 - 8:30am – 10:00am

Agenda



- **Project Overview**
- **Pre-Bid Challenges**
- **Segmental Superstructure Design**
- **Special Details**
- **Construction Engineering**
- **Q & A**

Project Overview – Existing Interchange



Overview of the Four Segmental Bridges



Project Details:

- 360,718 square feet of deck area
- 7,763 linear feet of bridge
- Longest span 266' and tallest pier 81 feet
- Number of segments 775

- **Bridge 9** – 2,310 feet long, 46 feet wide
- **Bridge 11** – 1,785 feet long, 46 feet wide
- **Bridge 15** – 1,100 feet long, 46 feet wide
- **Bridge 19** – 2,540 feet long, 46 feet wide

Pre-Bid Challenges



- Foundations
- Core of Interchange/MOT
- Erection Methods/Access
- Florida DOT Structures Guidelines
- Roadway Geometry



Pre-Bid Solutions



- 24" Precast Concrete Piles
- Build Superstructure from Top:
 - No temporary supports on the ground
 - Use a launching gantry
 - Segments – 80T
 - Stabilize off pier caps



Pre-Bid Solutions *Continued*



- Alternate Technical Concepts:
 - Mid-span expansion joints
 - Diabolos/External PT
 - Diaphragms and anchor blocks
 - Stay-in-place polystyrene forms
 - Variable depth segments

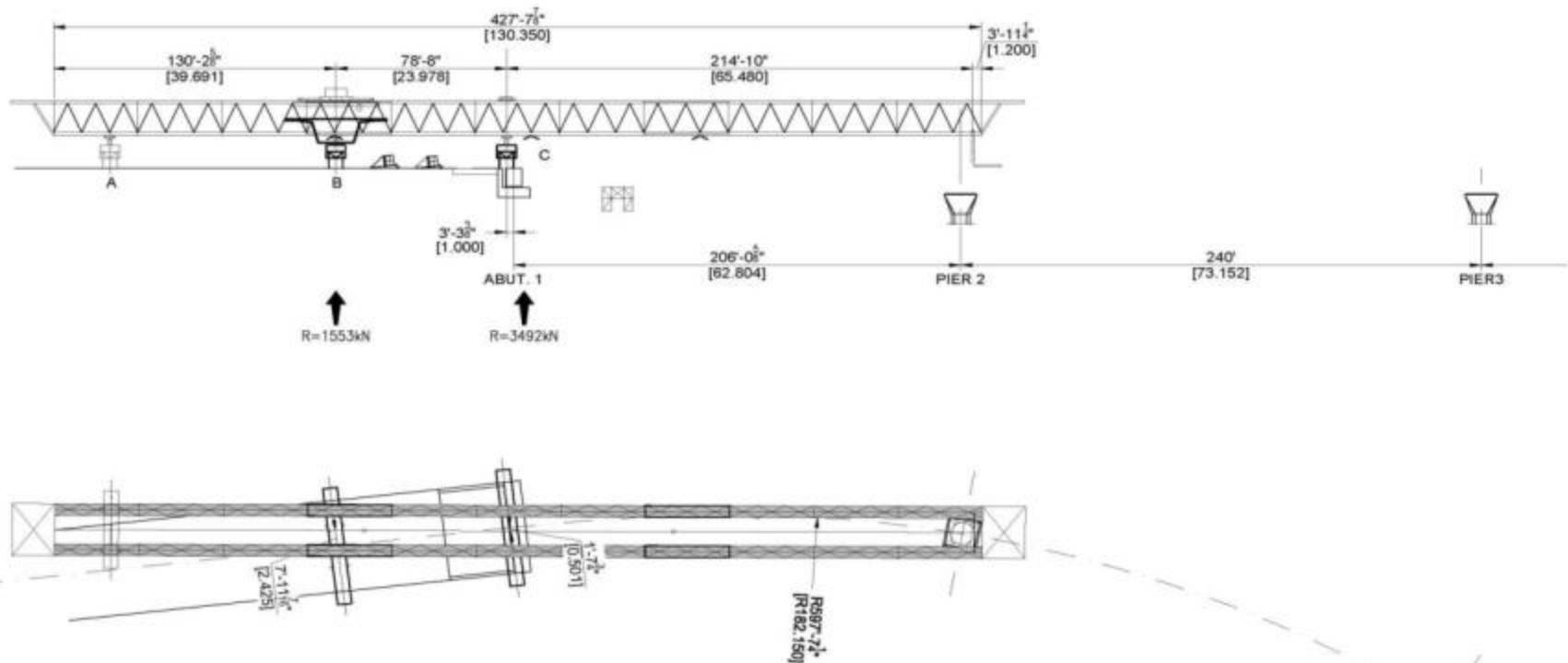


Segmental Superstructure Bridge Design



- **Overview Four Segmental Bridges**
- **Special Considerations**
- **Design Approach**
- **Special Details**
- **Construction Engineering**

Construction Sequences



- ERECT EJ SEGMENT AN 1st SEGMENT ON FALSEWORK
- LAUNCH FORWARD THE MAIN TRUSS

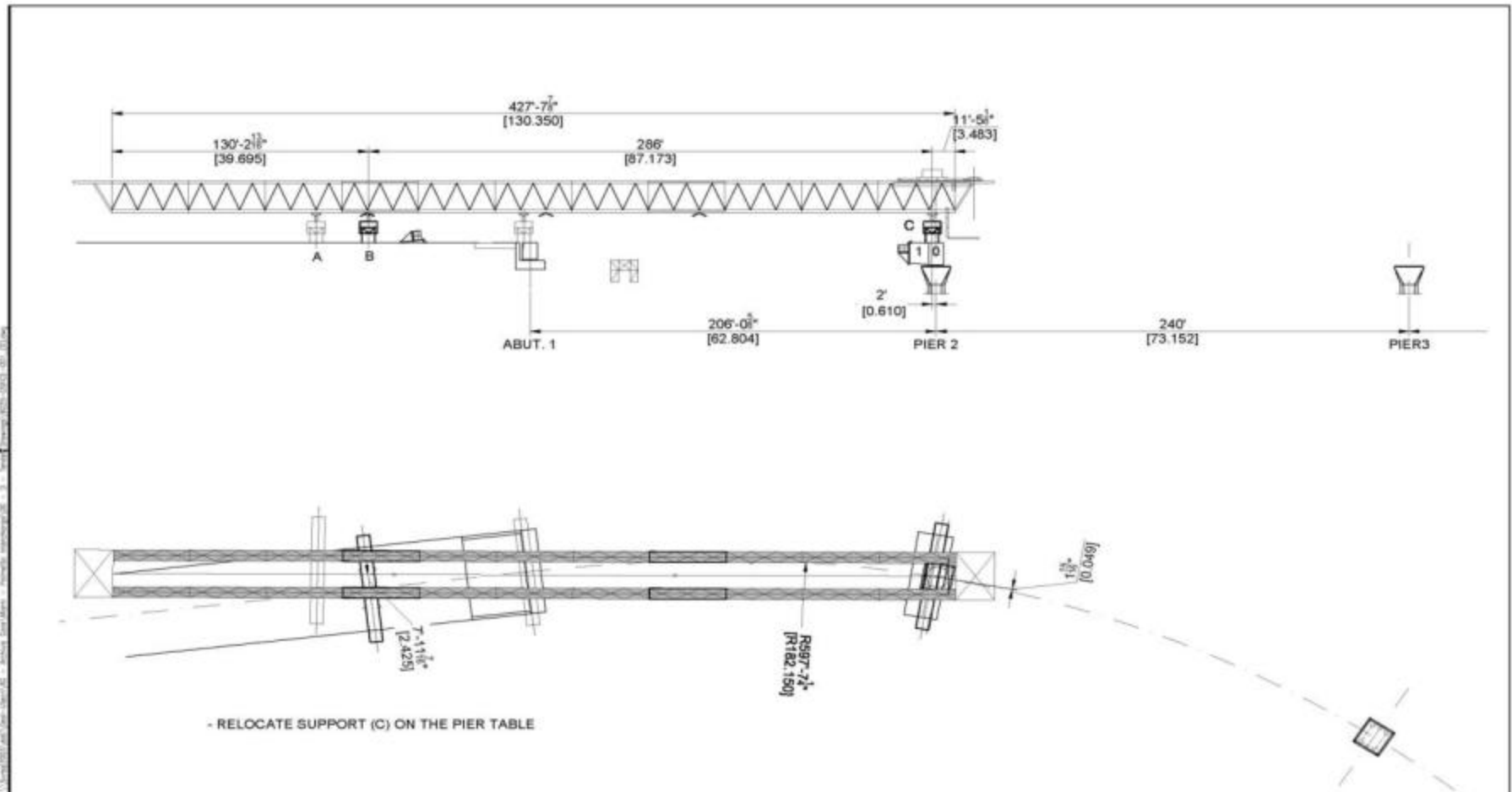
NOTE: ALL GANTRY REACTIONS SHOWN ARE UNFACTORED, WIND AND LONGITUDINAL FORCES SHALL BE CALCULATED ACCORDING TO THE CRITERIA SHOWN IN 9025-DSKCE-002

9025-DSKCE-002-11 - RIZZI DE ECCHER USA - Design - 01/17
 9025-DSKCE-002-11 - RIZZI DE ECCHER USA - Design - 01/17

02 Feb 2010 ISSUED FOR FOUNDATION DESIGN				PALMETTO EXPRESSWAY / DOLPHIN EXPRESSWAY INTERCHANGE COMPLEX	ERECTION SEQUENCES BRIDGE 15 R=598'-3"	9025 D SK CE 001 1/17	PRELIMINARY
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Construction Sequences

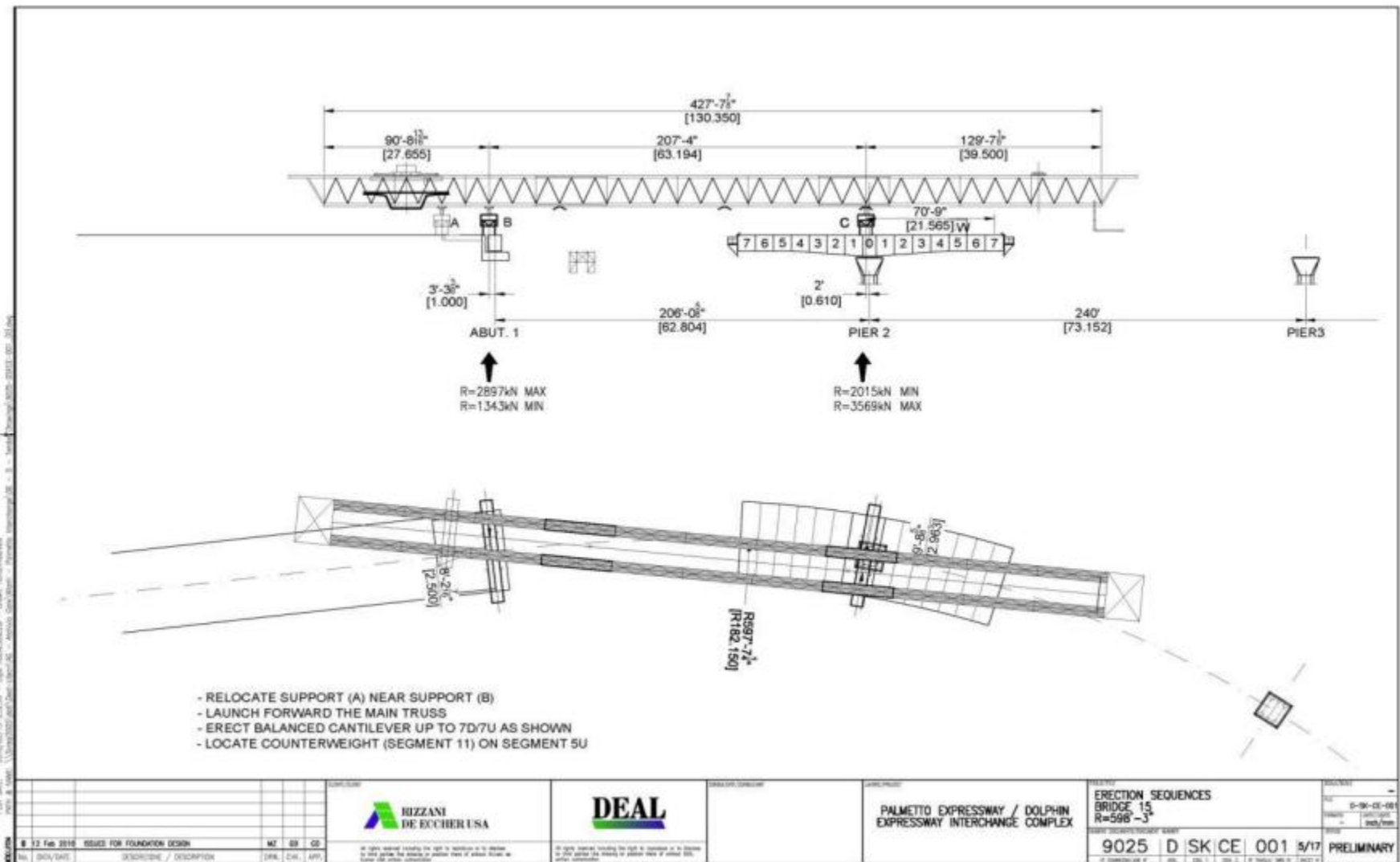


DATE: 02/15/17
 DRAWN BY: [REDACTED]
 CHECKED BY: [REDACTED]
 PROJECT: PALMETTO EXPRESSWAY / DOLPHIN EXPRESSWAY INTERCHANGE COMPLEX

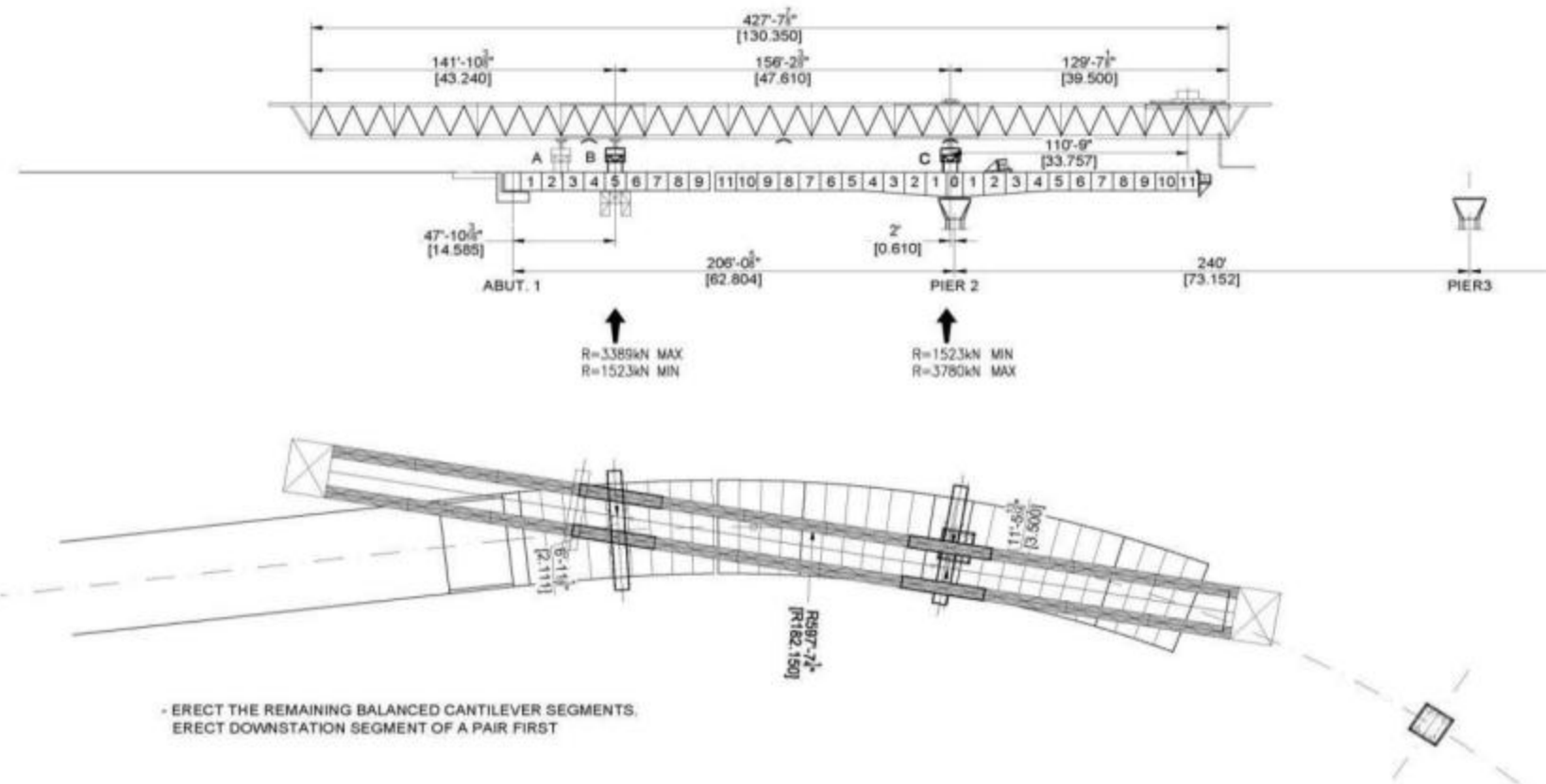
REVISIONS NO. DATE DESCRIPTION 1 02/15/17 ISSUED FOR FOUNDATION DESIGN			RIZZANI DE ECCHER USA	DEAL	PALMETTO EXPRESSWAY / DOLPHIN EXPRESSWAY INTERCHANGE COMPLEX	ERECTION SEQUENCES BRIDGE 15 R=598'-3" 9025 D SK CE 001 3/17	PRELIMINARY
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Construction Sequences



Construction Sequences



- ERECT THE REMAINING BALANCED CANTILEVER SEGMENTS.
ERECT DOWNSTATION SEGMENT OF A PAIR FIRST

PROJECT: 9025 - PALMETTO EXPRESSWAY / DOLPHIN EXPRESSWAY INTERCHANGE DATE: 12/14/17 DRAWING NO: 9025 D SK CE 001 R/17		RIZZANI DE ECCHER USA DEAL		PALMETTO EXPRESSWAY / DOLPHIN EXPRESSWAY INTERCHANGE ERECTION SEQUENCES BRIDGE 15 R=598-3 9025 D SK CE 001 R/17 PRELIMINARY	
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Superstructure



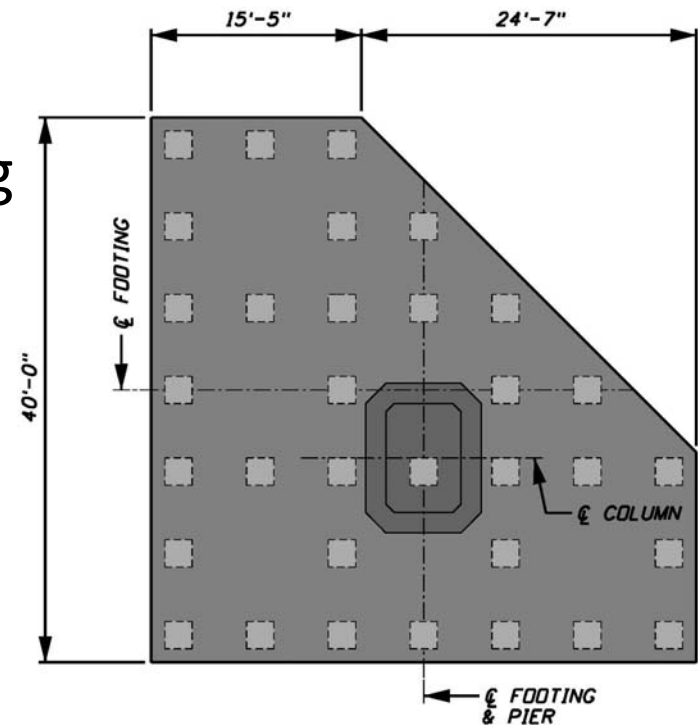
- Variable depth segments 12' to 9'
- Weight restrictions – 80^T
- Height restrictions – 16'6"
- External post-tensioning
- Anchorage/Diaphragm Design



Special Considerations



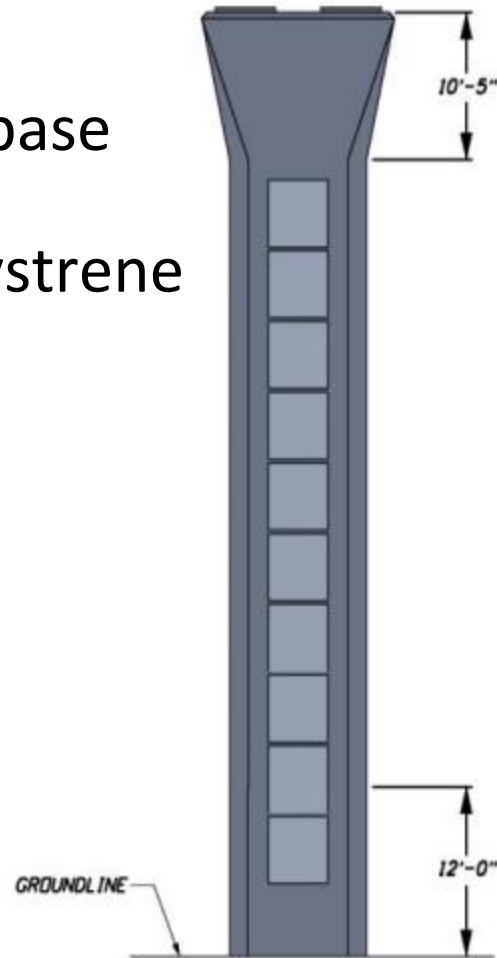
- Substructure and Foundations:
 - 24” Piles - 250 tons (C) & 25 tons (T)
 - Irregular Footing Shapes
 - Footing Depth – Shear Reinforcing
- MOT/Staging Considerations



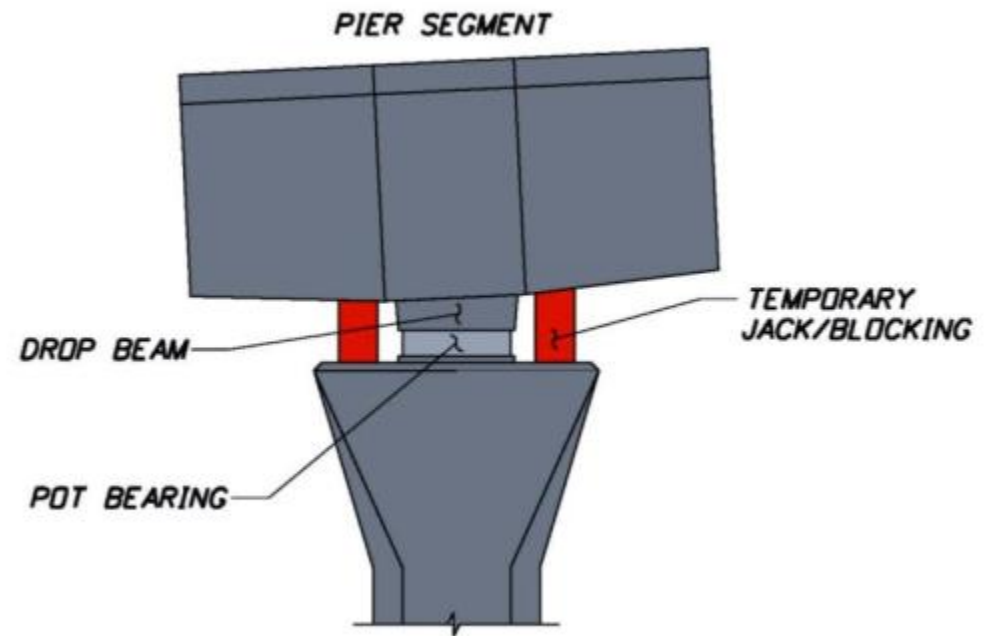
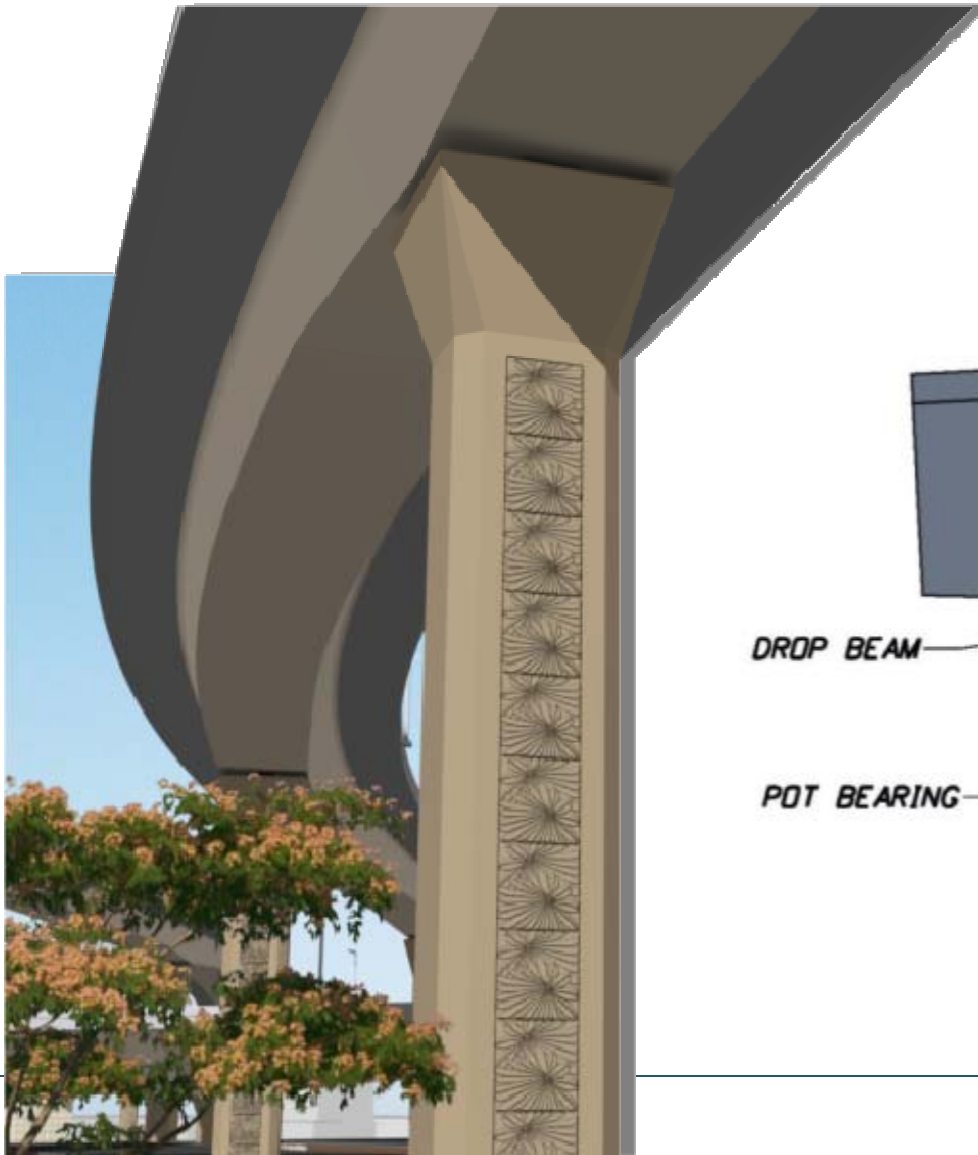
Special Considerations – Columns and Caps



- Columns and Caps:
 - Columns solid at the base
 - Box Column with Polystyrene
 - Solid Cap



Special Considerations – Cap Details



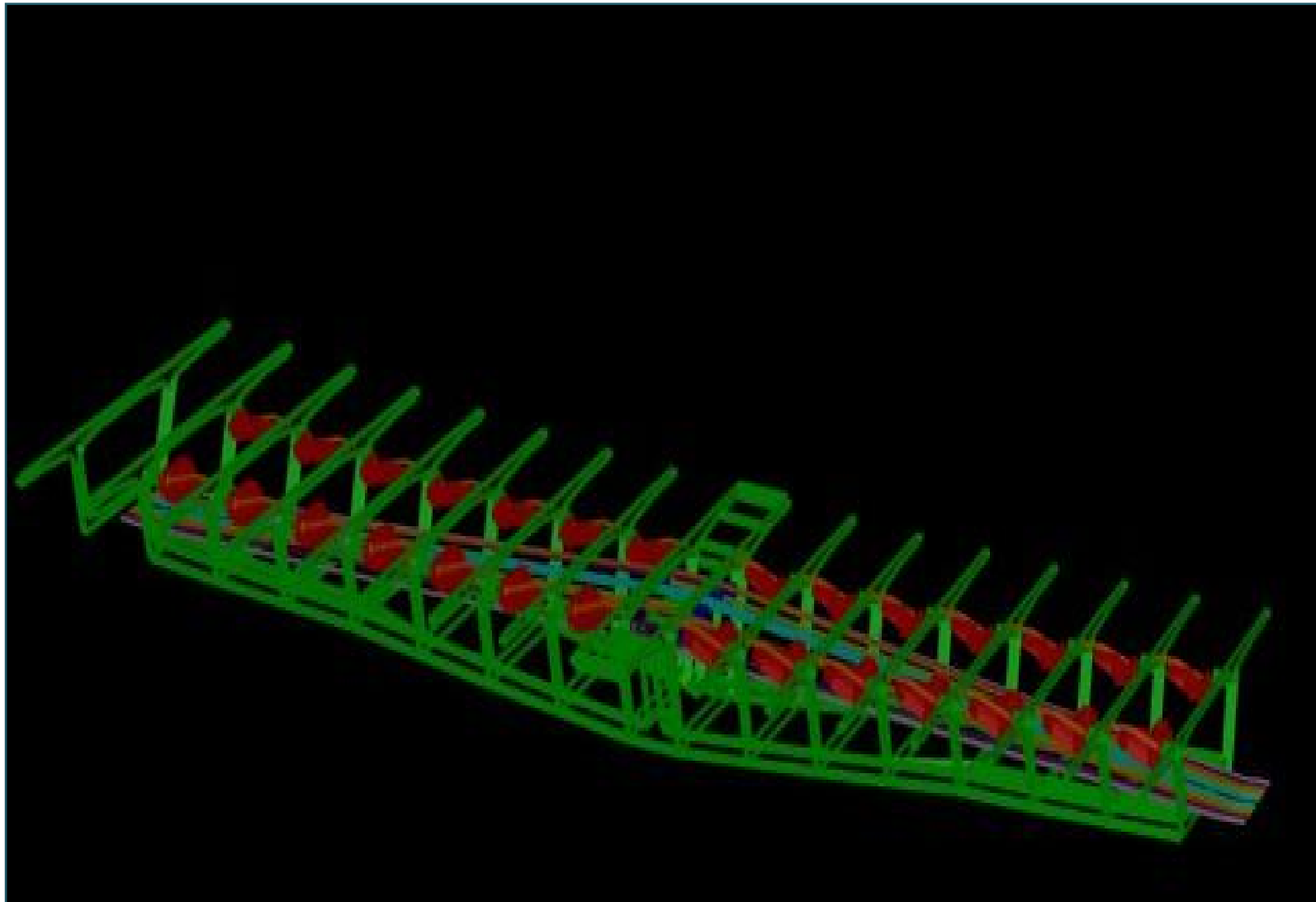
Cap was Key

Design Approach

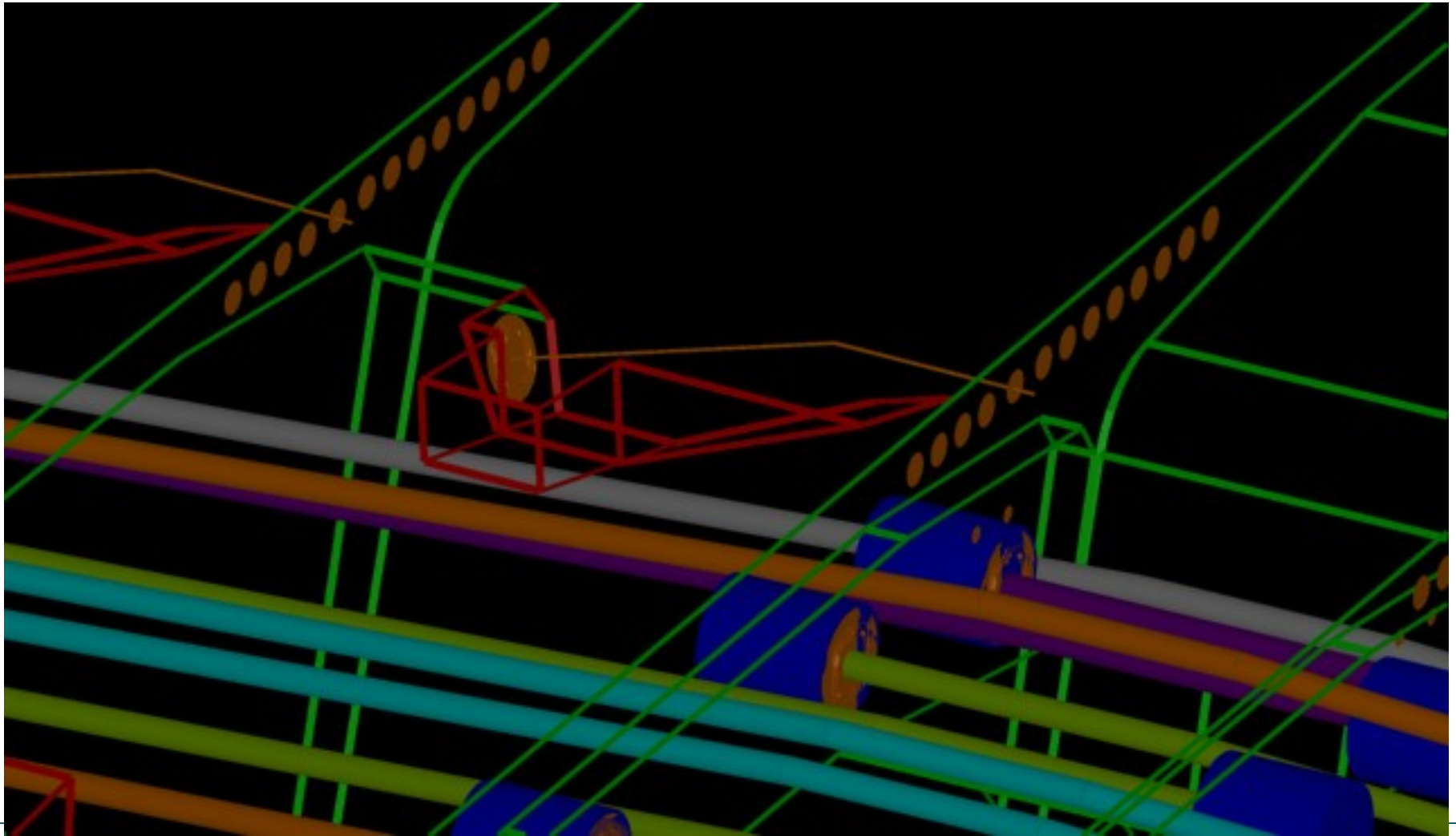


- BrIM Approach from the beginning
- All analysis – 3D and RM
- All drawings – MicroStation RmV8i and Rebar
- Construction sequencing and equipment

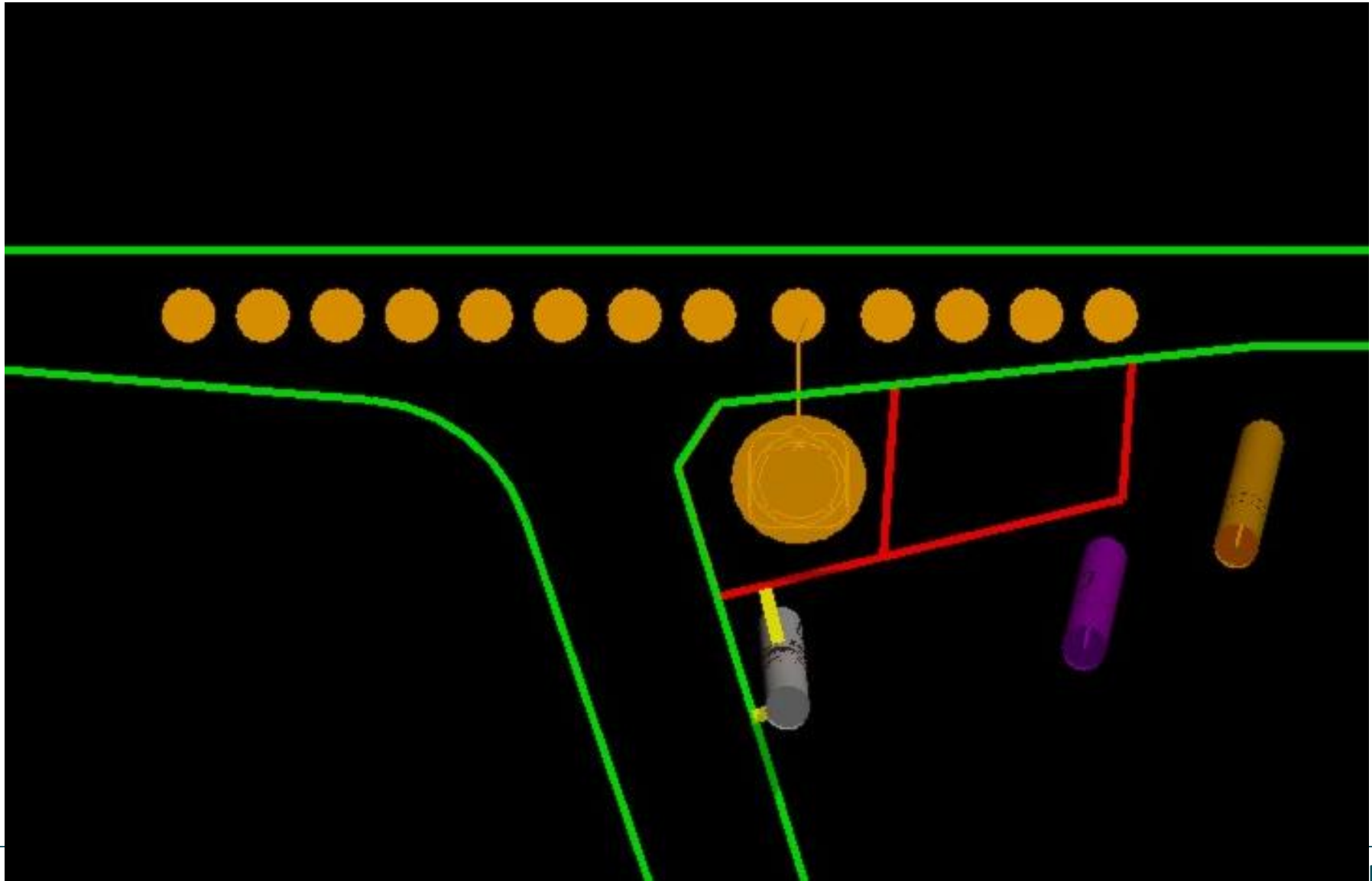
BrIM Modelling



Tendon Blister Clearance



External Tendon Clearance to Web



Design Approach



- Critical to the design of segmental structures
- Model needs to incorporate:
 - Changing boundary conditions
 - Phased addition of elements
 - Changes in statical scheme
 - Locked-in forces due to erection loads

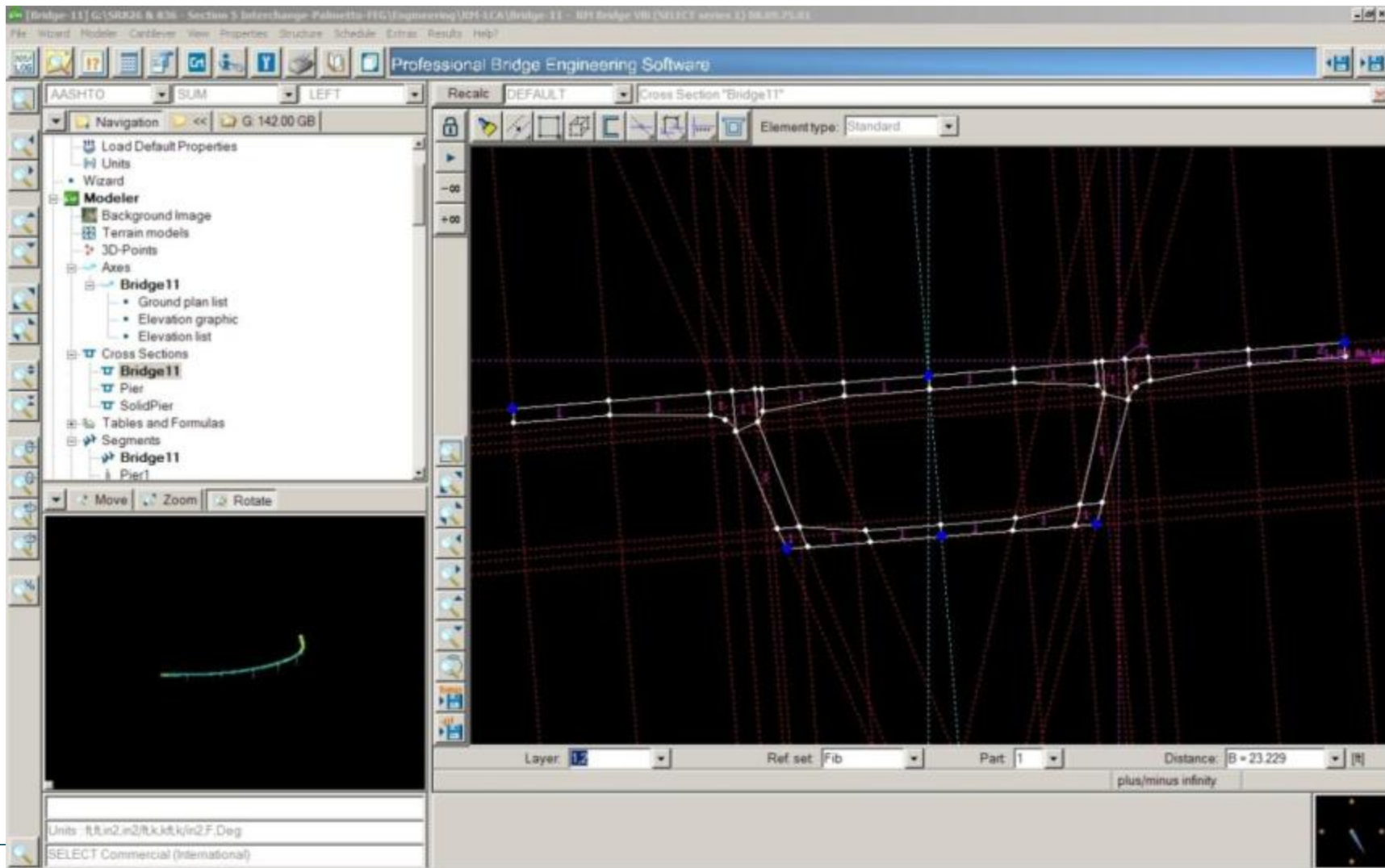
RM Bridge Model



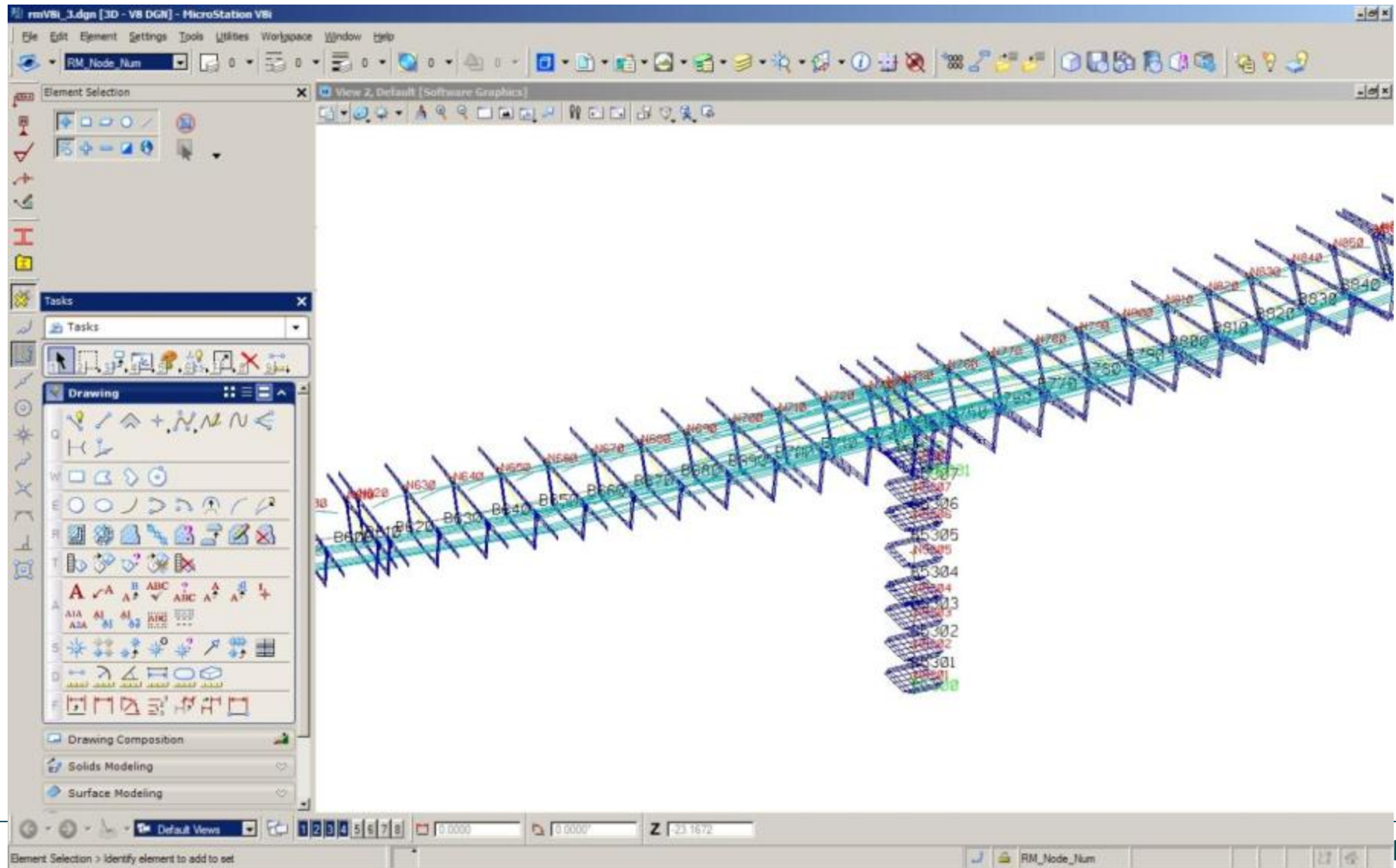
The screenshot displays the Professional Bridge Engineering Software interface. The main window shows a 3D wireframe model of a bridge structure. The interface includes a navigation pane on the left with a tree view containing categories like Elements, Sections, and Loads. A central panel shows various settings and options for the selected element. At the bottom, a table lists the properties of the elements in the model.

Type	Elem	Par	Clpnt	zRt	zCn	zC2	Par	spH2b	spC2b	AB	Line	RFEm
Normal	100	CSP	PP10	0.10	0.00	0.00	Elem	Free	Free			
Line	100	CSP	PP10	0.00	0.00	0.00	Elem	0.011	0.00		Yes	
CP	100	CSP	PP10	0.09	0.00	0.00						
Line	100	CSP	PP10	0.07	-0.10	0.00	Elem	-0.040	0.00		Yes	1000
Normal	100	CSP	DF10	0.00	0.140	0.00	Elem	0.005	-0.00			

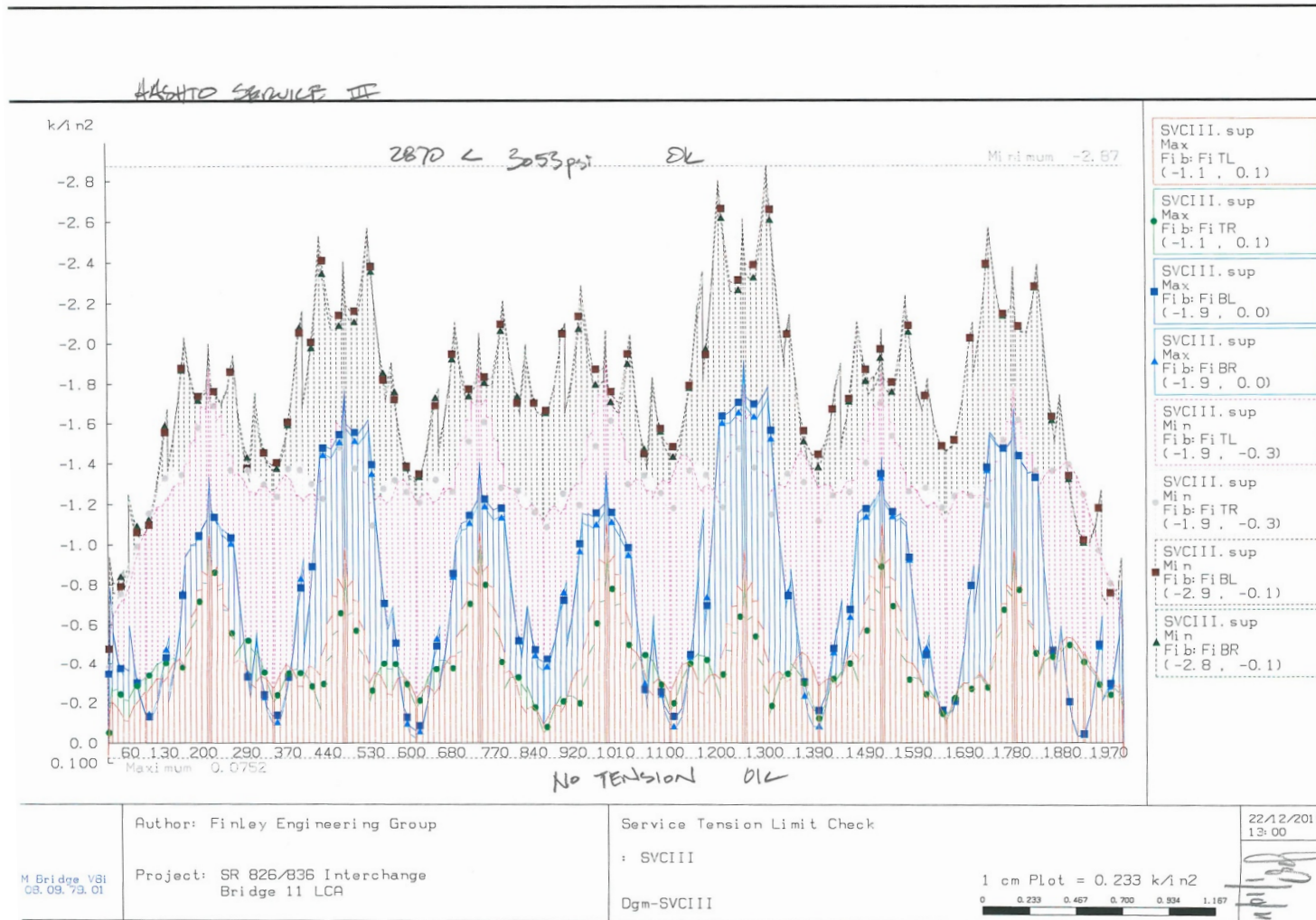
Design Approach



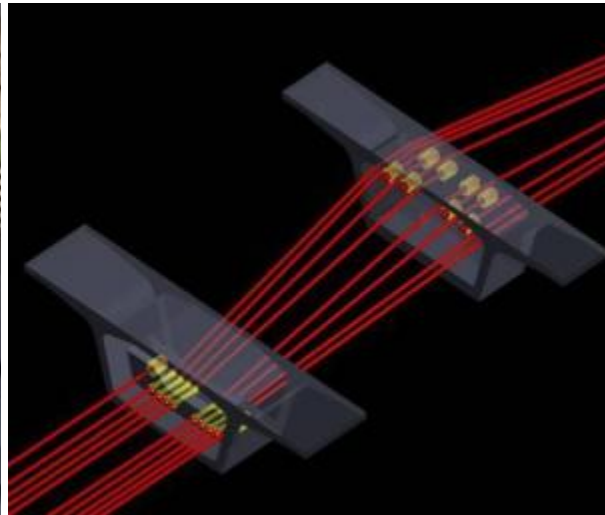
Design Approach



Design Approach



Special Details



- Internal Cantilever PT Blister
- Anchorage & Diaphragm
- Diabolos
- Pier Segment Drop Beams
- Temporary Pier Tie Downs
- Minimized Expansion

Joints

Special Features – PT Blister/Anchorage Diaphragm/Diabolos/Down Strand/Tie Downs/Expansion Joints

Diabolos

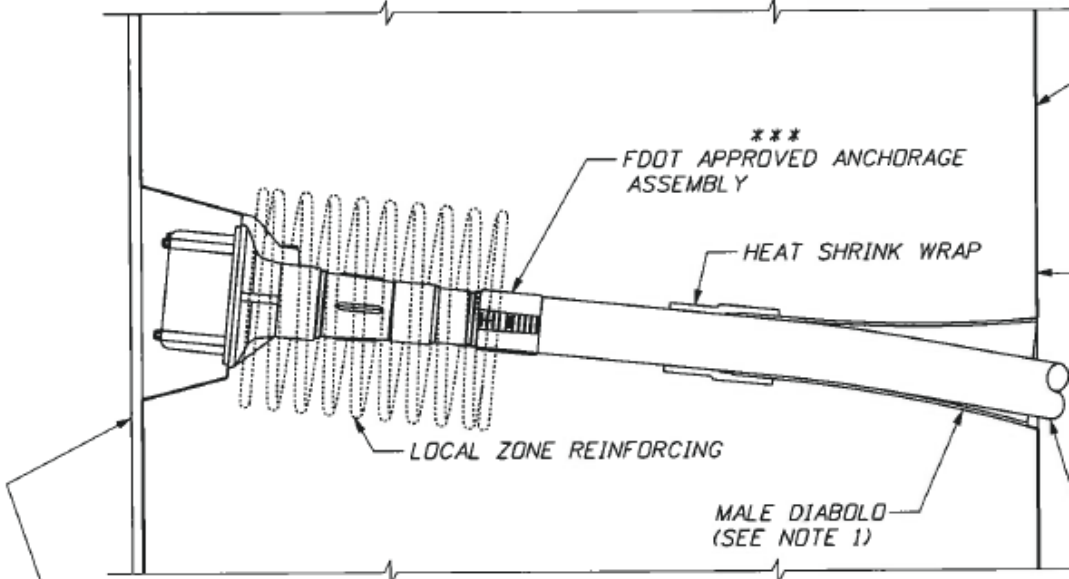


Diabolos

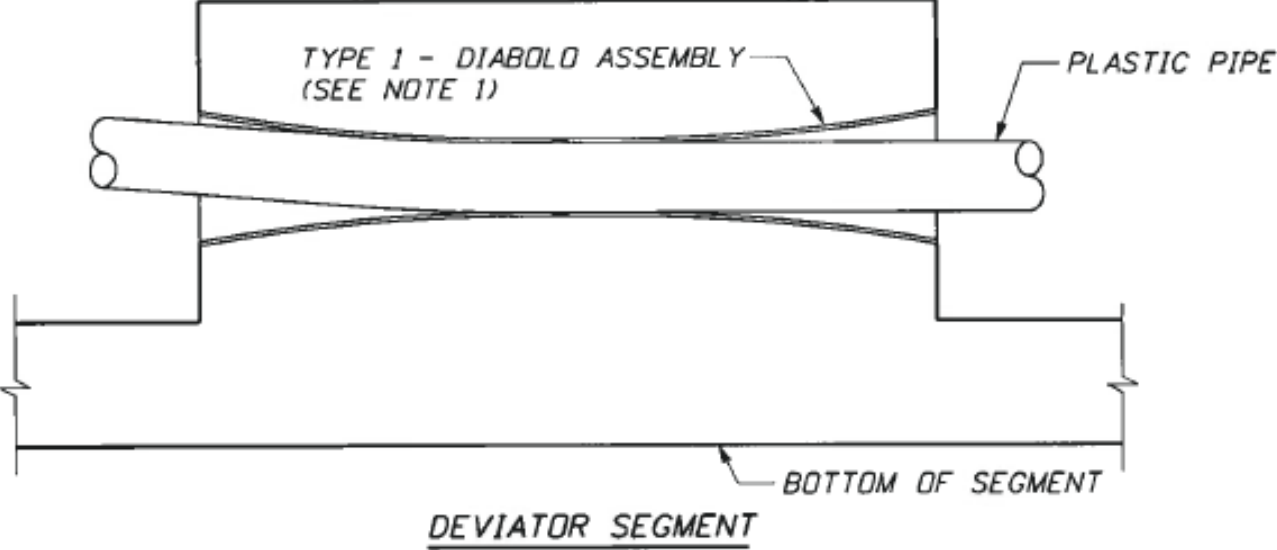


- **First use of Diabolos in Florida:**
 - Permitted as an ATC under a project specific Modified Special Provision
 - Limited to 10ft radius within diablo
 - Allow tendon variable tendon geometry and continuous external tendon duct
 - Required testing of wear resistance and creep for approval

Diabolos



TYPE 1A ANCHORAGE
PROTECTION, FDOT
INDEX 21802



Diabolo Test Result



Construction Engineering



- **FINLEY services provided:**
 - Integrated segment drawings
 - Construction analysis
 - Temporary Works
 - Geometry Control
 - Technical Support

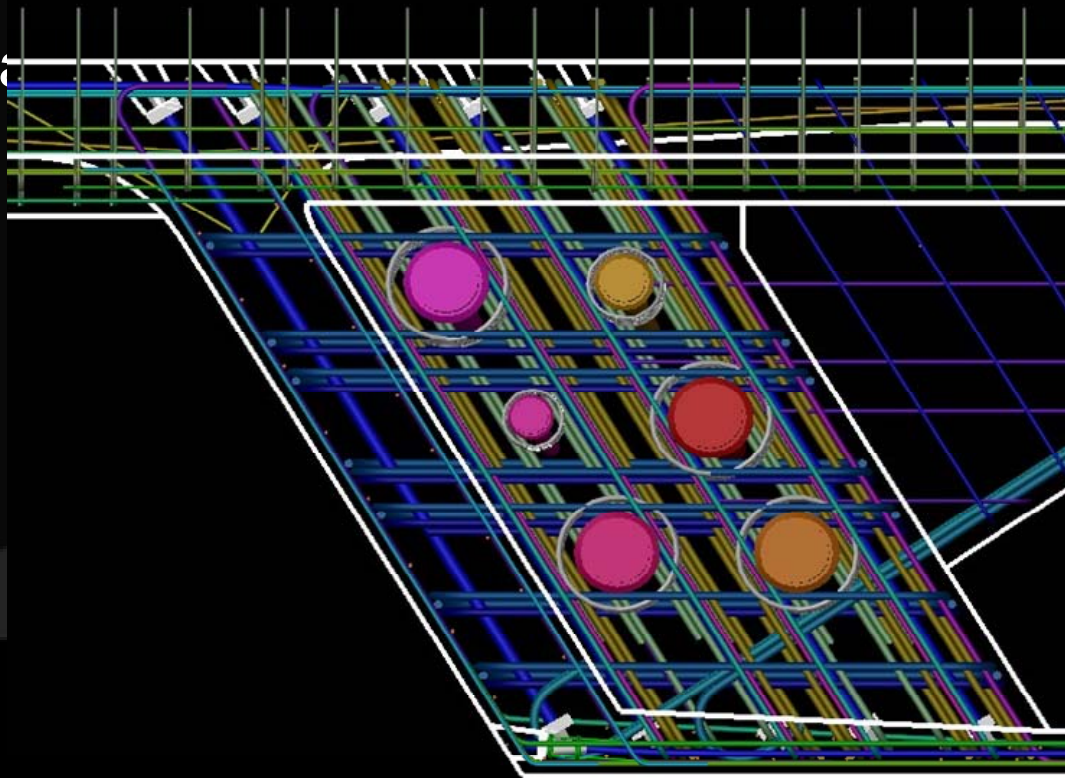


Integrated Shop Drawings



End View from 3-D Drawing

- S



Anchorage Zone Reinforcement



Pier Segment Reinforcing Cage

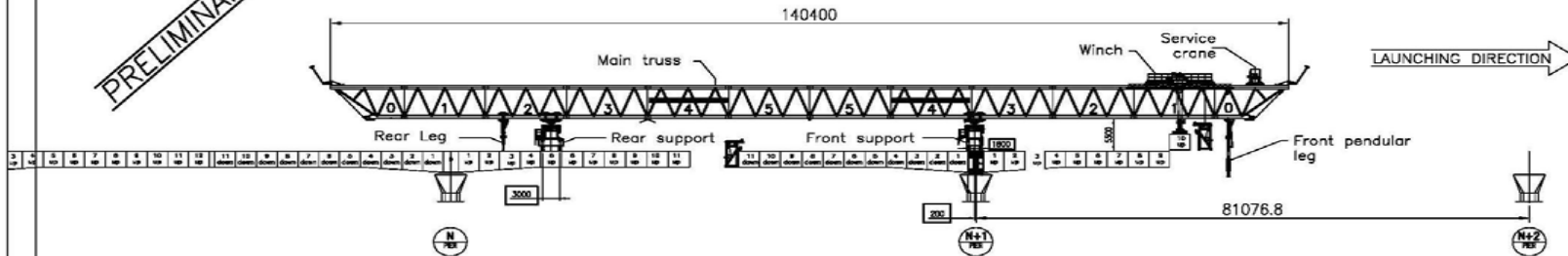


Launching Truss



PRELIMINARY

CANTILEVER CONSTRUCTION – SAMPLE CONFIGURATION



DEAD LOADS

MAIN TRUSS + HEADS	2580 kN
REAR LEG	160 kN
REAR SUPPORTS (B)	450 kN
FRONT SUPPORT (C)	440 kN
FRONT PENDULAR LEG	150 kN
WINCH + MANIPULATOR	275+65= 340 kN
SERVICE CRANE	27 kN
STRESSING PLATFORM	2x49= 98 kN
TOTAL	4245 kN

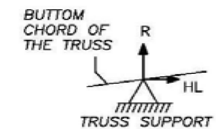
SEGMENT WEIGHTS

SEGMENT n°	P	1D/1U	2D/2U	3D/3U	4D/4U	TYP	DEV	EJ	
WEIGHT	kN	800	660	630	600	570	580	710	800

TRASVERSAL LOADS DUE TO WIND IN WORKING CONDITIONS

The following loads refer to wind speed of 20 m/s (72 km/h) – 250 N/m² and wind direction perpendicular to the main truss

MAIN TRUSS+HEADS	190 kN
WINCH + MANIPULATOR	5 kN
SERVICE CRANE	2 kN
AUXILIARY LEG	6 kN
REAR + FRONT SUPPORTS	2 x 6 = 12 kN
FRONT LEG	8 kN
SEGMENT	5 kN
TOTAL WIND LOADS	HTTOT = 228 kN



LONGITUDINAL LOADS DUE TO WIND AND SLOPE

On anchored support: HL= 0.5xHTTOT + vertical reaction R on free support x (p+m)%

On free support: HL= vertical reaction R on free support x (p+m)%

where p = longitudinal slope % (max 5%), m = friction factor (1%)

Revision	Date

DEAL

Stato e stabilimento
Via Sante Felice Caprioni
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REFERENCE:

LAUNCHING GIRDER L66

TITLE:

EQUIPMENT DATASHEET

SCALE: /

DATE: 28/09/10

FILE:

DRW.: DT

DRAWING:

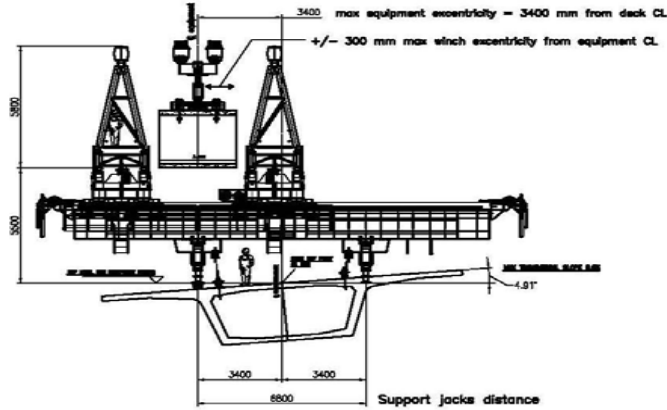
L66DUDDO 001 REV 0
sheet 1 of 2

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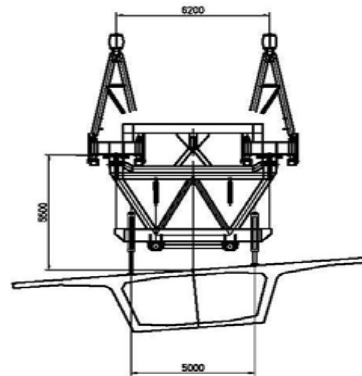
Launching Truss



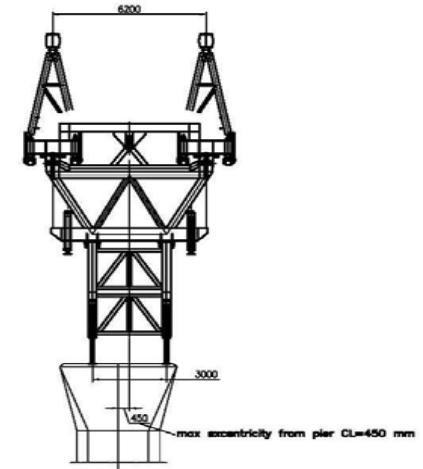
FRONT/REAR SUPPORT



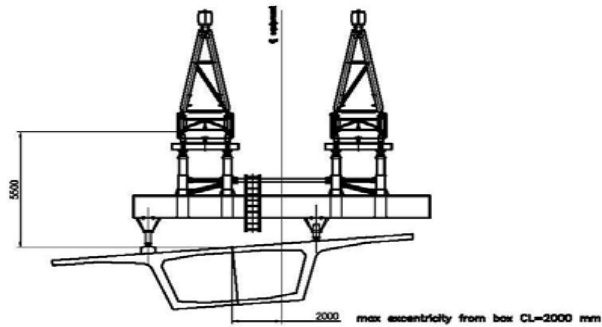
FRONT LEG ON DECK



FRONT LEG ON PIER



REAR AUXILIARY LEG



PRELIMINARY

Revision	Date

DEAL

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REFERENCE:	LAUNCHING GIRDER L66	SCALE: /	DATE: 28/09/10
TITLE:	EQUIPMENT DATASHEET	FILE:	DRW.: DT
		DRAWING:	L00DULS0001 REV 0
			sheet 2 of 2

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Similar Equipment



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Questions and Answers

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